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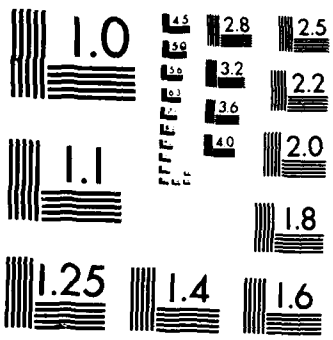

A FORMULA FOR USE IN UNABSORBED OVERHEAD CLAIMS IN GOVERNMENT CONTRACTS

THESIS

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AFIT/GLM/LSQ/86S-30

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THESIS

Presented to the Faculty of the
School of Systems and Logistics
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Frank R. Groseth

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Abstract

This ~~research~~ is a continuation of the research conducted by First Lieutenant Timothy Edem in 1985. While Edem's research studied the accuracy of a variety of formulas, this ~~research~~ concentrated on development of a new formula and its comparison to the two most popular formulas currently in use, the Allegheny and the Eichleay. The goal of this research was to develop a formula for use in unabsorbed overhead claims that would equitably determine the government's liability.

The formula development was based on the contract law principle of "making the injured person whole." It was using this principle that the government's share of delay period overhead was determined. The analysis and formula development were conducted in much the same manner as Edem's. Simple examples of possible real world situations were used to develop and evaluate the Fair Share Formula, as the new formula is called, and the results compared to solutions using the Allegheny and Eichleay Formulas. Edem's findings concerning the Allegheny Formula were validated here, however, his findings concerning the Eichleay Formula, while generally valid, were not completely valid. In some situations, the Eichleay Formula was found to understate the government's share of overhead. This occurred in a relatively small range of delay period activity and was

offset by the large overstatement in a much larger range of activity. The Fair Share Formula accurately computed the government's share of delay period overhead through the full range of delay period activity. The results obtained here warrant the consideration of this formula for use in delay claims by contracting officers, contractors and Boards and Courts of Appeal.

A FORMULA FOR USE IN UNABSORBED OVERHEAD CLAIMS IN GOVERNMENT CONTRACTS

I. Introduction

General Situation

In many contracting situations, a government caused delay results in the contractor incurring unreimbursed overhead. This occurs because some expenses a contractor experiences are not related to the level of business activity but are fixed in nature: they exist and continue regardless of the level of business activity occurring in the firm. A delay imposed or caused by the government may, and in most cases will, prevent the contractor from completing the contract in the originally agreed time frame. For the amount of time the contract exceeds the original contract period, the contractor is incurring fixed overhead costs that were not part of the original contract price and therefore not paid for by the government. An example of such a situation would be where facilities were rented for a specific contract and would be vacated after the completion of that contracted work. Given a government caused delay, the rent for this facility, the associated utilities and the insurance premium for the facility during that delay would be overhead not part of the original price and therefore not

paid for by the government. A more common example would be salaried personnel who would not be laid off during a single contract delay. These categories of expense are typically referred to as unabsorbed overhead or underabsorbed overhead. A contractor in this situation may file a claim against the government in order to recover those additional expenses. While the "entitlement," or fact of damage (additional costs incurred) may not be a point of disagreement, the "quantum," or amount of such damages is extensively argued.

Specific Problem

Various formulas have been used in determining the just amount of compensation. Generally, these formulas have assumed the names of the companies involved in claims cases brought against the government. In a 1985 study, First Lieutenant Timothy Edem investigated the accuracy of six such formulas: the "Allegheny," the "Carteret," the "Eichleay," the "Allied Materials and Equipment Company," the "A.C.E.S.," and a simulation model (6). Each formula was found to understate or overstate unabsorbed overhead in all but the simplest of situations (6:125-126). The search for an easily used and understood formula that is accurate still continues.

Key Terms

Delay: A delay is "[w]here the government's action (or inaction) prevents the contractor from completing the

contract within the period contemplated in the contract..." (13:112). The cause of the delay becomes the significant point for this study. A government caused delay, resulting in some damage (added cost) to the contractor, is basis for a claim against the government (2:347). It is in this sense that the term is used in this research.

Indirect Cost or Overhead:

> Any cost not directly identified with a single final cost objective, but identified with two or more final cost objectives or with at least one intermediate cost objective." (4:5113)

Fixed Overhead:

> Costs which remain unchanged despite changes in volume are called fixed or nonvariable. Usually such costs are incurred as a function of some other factor such as time. For example, the annual insurance premium and license fee on an automobile are fixed costs since they are independent of the number of miles driven. (10:952)

Variable Overhead:

> A variable cost increases directly and proportionally with changes in volume. If, for example, volume increases 10%, a variable cost will also increase by approximately 10%. Gasoline is an example of a variable automobile cost, since fuel consumption is directly related to miles driven. (10:952)

Overhead Rate: The amount of overhead that is to be allocated for each dollar expense incurred for some related base. This is expressed as a percentage of that base. For example, if it is found that $212 of overhead is incurred, on the average, for every $100 of direct labor, the overhead rate would be $212 divided by $100 or 212%. This rate then could be applied to various jobs or contracts. As an

example, if there was $5500 of direct labor associated with a particular job, the overhead charged to that job would be $5500 times 212% or $11,660.

Reasonableness: The Defense Acquisition Regulation and the Federal Procurement Regulation define reasonableness as follows:

> A cost is reasonable if, in its nature or amount, it does not exceed that which would be incurred by an ordinarily prudent person in the conduct of competitive business. What is reasonable depends upon a variety of considerations and circumstances involving both the nature and amount of the cost in question. In determining the reasonableness of given cost, consideration shall be given to--
>
> (i) whether the cost is of a type generally recognized as ordinary and necessary for the conduct of the contractor's business or the performance of the contract;
>
> (ii) the restraints or requirements imposed by such factors as generally accepted sound business practices, arm's length bargaining, Federal and State laws and regulations, and contract terms and specifications;
>
> (iii) the action that a prudent business man would take in the circumstances, considering his responsibilities to the owners of the business, his employees, his customers, the Government and the public at large; and
>
> (iv) significant deviations from the established practices of the contractor which may unjustifiably increase the contract costs. (2:159-160)

Allocability: The Cost Accounting Standards Board (CASB) has explained allocability as

> ... an accounting concept involving the ascertainment of contract costs; it results from a relationship between a cost and a cost objective such that the cost objective appropriately bears all or a portion of the cost. For a particular cost objective to have allocated to it all or part

> of a cost there should exist a beneficial or causal relationship between the cost objective and the cost. (2:159)

> Allowability: The CASB has defined allowability as ... a procurement concept affecting contract price and in most cases is established in regulatory or contractural provisions. An agency's policies on allowability of cost may be derived from law and are generally embodied in its procurement regulations. (2:159)

The Defense Acquistion Regulation (DAR) states:

> Factors to be considered in determining the allowability of individual items of cost include (i) reasonableness, (ii) allocability, (iii) standards promulgated by the Cost Accounting Standards Board, if applicable, otherwise, generally accepted accounting principles and practices appropriate to the particular circumstances, and (iv) any limitations or exclusions set forth in this Part 2, or otherwise included in the contract as to types or amounts of cost items. (2:158)

Replacement Work: That work taken on by a contractor during a delay period that could not have been taken on (due to limited resources) if the delay had not occurred.

Scope and Limitations

Edem's research, being thorough and comprehensive, needs no repetition here. This thesis will not repeat his study but build upon it. Edem's research showed that each formula that has been used in determining equitable settlement in delay cases has flaws and does not produce an accurate figure for unabsorbed overhead in delay cases. His research included the two most widely used methods, the "Alleghany" and the "Eichleay," and proved them inaccurate in all but the simplest of cases (6). As in Edem's study, the causes of the

delays will not be investigated. This research deals strictly with question of quantum and not entitlement.

Objectives

The main objective of this study is to develop a formula that is easily understood and accurate for use in determining an equitable settlement in claims against the government involving government caused delays. Once developed, this formula will be shown to provide equitable and accurate solutions. This study, hopefully, will provide the basis for acceptance by the contracting, accounting and legal communities.

II. Literature Review

Introduction

The literature on the subject of unabsorbed overhead is quite limited. Other than legal opinions, the only research conducted on the subject was done by Timothy Edem in 1985. His review of what little has been written on the subject was very thorough and will not be repeated here. Of course decisions by the courts and various boards of appeal have continued. However, no new precedents have been set. The substance of his review remains unchanged. A review of his research and other pertinent works follows.

Edem's investigation involved five methods that had been ruled on by various appeals boards and courts and one that had been proposed but not tested in the appeals process. Edem, using very simple examples in his analysis, showed that each of these methods, or formulas, did not represent accurately the amount of unabsorbed overhead in his simple examples and therefore could not be expected to accurately perform in the more complicated real world (6). A brief summation of Edem's examples, the formulas, and how each formula performs using the three examples follows.

Example 1 is a contractor with one employee working on a contract that incurs a government caused delay. During the delay, no work is found for that employee (6:38-39).

Example 2 is a contractor with one employee working on a contract that is delayed as in Example 1. However, during

this delay, other work is found for half the delay period (6:52-53).

Example 3 is a contractor with 2 employees working on a contract that is delayed. During the delay, one employee is laid off and the contractor finds work for the other employee for half the delay (6:67-68).

The Formulas

The Allegheny Formula developed through a claim and an appeal filed by Allegheny Sportswear Company. The initial claim dates back to 1953. Findings in the first appeal of this case directed the Army to compensate Allegheny for a delay caused by the Army. A subsequent appeal was filed concerning the amount of the compensation. The resulting court findings established the basis for the Allegheny Formula (6:11-12,14-17).

The Allegheny Formula appears below:

Actual Overhead Rate Experienced for Total Time Period Including Delay	-	Overhead Rate for the Projected Contract Period	=	Rate of Under-absorbtion
Rate of Under-absorbtion	X	Allocation Base in Contract	=	Unabsorbed Overhead

(Adapted from source 6:15-16)

The essence of this formula is that the actual rate of overhead incurred for the entire period has the rate agreed to in the original contract subtracted from it to give a rate which represents the rate at which overhead is not

being properly absorbed. This is then multiplied by the allocation base for the overhead to arrive at a figure for unabsorbed overhead. Edem found this formula understates unabsorbed overhead in all but the simplest case (Example 1) where no replacement work was found during the delay (6:92,102,116).

The Eichleay Formula seems to be the most popular from the contractor's point of view. "In about 90% of all delay claims the appellant requests the use of the Eichleay formula" (6:21). On the other hand, the government seems to shy away from the use of this formula (13:115,122;5:14). The controversy around the use of this formula is typical of the legal warfare being conducted over unabsorbed overhead. The Eichleay Formula was originally proposed by the Eichleay Corporation, an Army construction contractor, in 1960. The contractor's claim arose from delays under the Suspension of Work clauses of contracts for the construction of three NIKE missile sites in the Philadelphia area. Both the government and the contractor agreed that there was in fact a government caused delay and further agreed on the number of days of delay and the direct costs involved in the delays. The sole point of contention was the amount of overhead to be allocated to the delays. The Eichleay Formula ."... computes...[the]... claimed amount by determining a daily overhead dollar amount and multiplying it by the agreed number of days of delay" (7:13,568). The Eichleay Formula is as follows:

Total Contract Price	-:-	Total Billings for Full Contract Period	X	Indirect Costs for Contract Period	=	Indirect Costs Allocable to Contract

Allocable Overhead	-:-	Total Days of Performance	=	Daily Contract Overhead

Daily Contract Overhead	X	Days of Delay	=	Indirect Costs Recoverable

(Source 12:86227)

There seems to be quite a difference of opinion regarding the use of the Eichleay and Allegheny Formulas. The government tends to advocate the Allegheny Formula. Note, as shown by Edem's research, the Allegheny Formula understates unabsorbed overhead in all but the simplest of cases (6:92,102,116). On the other hand, contractors favor the Eichleay formula. Here Edem's research shows that unabsorbed overhead is overstated in all but the simplest (Example 1) of cases (6:92,102,116). Paul M. Trueger in his authoritative Accounting Guide for Government Contracts, Eighth Edition, takes the position that the government is in conflict with legal reality by promoting the Allegheny Formula over the Eichleay Formula.

> A review of DCAA's guidance in this area and a comparison of the formula it proposes with that used by boards and courts establishes that the audit agency, *without any authorization or approval by authorative [sic] government sources*,has established its own concepts, ignored the decisions by boards and courts, and has thus led the government into many actions which resulted in costly litigations to both parties. *In virtually all instances the DCAA's position has been overturned.* (13:122-123)

Trueger cites many cases where Eichleay has been used and upheld by various boards and appeal courts (13:123-142). It seems quite clear that this is the preeminent formula of today. Since Edem has shown that the Eichleay Formula overstates unabsorbed overhead in most cases, the government may be needlessly paying contractor's claims for overhead.

Three other formulas, the Carteret, the Allied Materials and Equipment Company, and the A.C.E.S., were investigated by Edem. None of these formulas have received much support from the government, contractors, boards or appeal courts. A brief summation of each formula follows as well as Edem's findings concerning each method.

The Carteret Formula arose in 1956 from an appeal filed by Carteret Work Uniforms for their claim of delay of government supplied fabric used in the making of work uniforms. The method was based on the idea that there is an "anticipated overhead" that can be expected to occur during a delay period. An actual written out formula was not stated in the appeal's findings but was derived by Edem from the board's procedure (6:12-13). The formula appears below:

Actual Overhead Rate	X	Actual Labor Dollars	=	Anticipated Overhead
Actual Overhead	-	Anticipated Overhead	=	Amount Claimed

(Source 6:13)

Edem's research found that this formula accurately

determined unabsorbed overhead for his three examples (6:52,66,80) but is flawed by its lack of capability to adapt to changing overhead rates, such as the addition of additional labor thus changing the allocation base (6:14,118).

The Allied Materials and Equipment Company Formula (hereafter referred to as Allied) developed from a termination of a government contract. When Allied appealed the contracting officer's judgement using the Eichleay Formula in 1975, the Board of Contract Appeals (BCA) felt that this was inappropriate in this case and developed a "fluctuation method." The formula is shown below:

Actual Cost Burden Rate	-	Bid Cost Burden Rate	=	Fluctuation Burden Rate
Total Plant Labor	-	Contract Labor	=	Residual Labor
Fluctuation Burden Rate	X	Residual Labor	=	Unabsorbed Indirect Factory Expense

(Source 1:53089-53090)

The same computations were accomplished for General and Administrative (G&A) expense and the two unabsorbed subtotals added together for a total unabsorbed overhead (1:53090). The Allied Formula was found to underestimate actual unabsorbed overhead in all cases (6:52,66,80,125).

The A.C.E.S. Formula also evolved from a government termination, this time in 1979. "The basic assumption in this formula is that unabsorbed overhead is computed by

multiplying a fixed hourly overhead rate with the number of hours that were lost from production, due to the delay" (6:26). The description follows:

Fixed Overhead Costs	-:-	Total Overhead Costs	=	Fixed Overhead Rate
Total Overhead Rate Per Labor Hour	X	Fixed Overhead Rate	=	Fixed Overhead Rate Per Labor Hour
Lost Labor Man-hours	X	Fixed Overhead Rate Per Labor Hour	=	Unabsorbed Overhead

(Source 6:26)

This formula was found to overestimate unabsorbed overhead when partial compensatory work is found for some employees previously assigned to the delayed contract (6:52,66,80,126).

The Simulation Method was developed in response to the lack of accuracy found in other formulas. It was proposed by by James P. Bedingfield and Howard W. Wright in their text, Government Contract Accounting. No instances were found where this formula has actually been used but was included in Edem's research as a theoretical approach. The formula is as follows:

Contract Billings	-:-	Actual Days Worked	=	Average Contract Billings Per Day Worked
Average Contract Billings Per Day Worked	X	Number of Days of Delay	=	Simulated Additional Work

Simulated Additional Work	+	Contract Billings	=	Simulated Contract Billings

Simulated Contract Billings	-:-	Simulated Total Billings	X	Total Overhead During Contract Including Delay	=	Overhead Allocable to Contract

Overhead Allocable to Contract	-	Overhead Actually Allocated to Contract	=	Unabsorbed Overhead

(Adapted from source 2:349-350)

Even though this approach was invented to overcome the shortcomings of the Eichleay and other methods, Edem found that this formula overstates the true unabsorbed overhead in all but the simplest example (Example 1) (6:52,66,80,126).

Summary

While the volume of legal opinions concerning unabsorbed overhead in general is quite large, most of the legal writings (case briefs) deal with the legal technicalities. Since this research deals only with the method of determining the amount of damages to be awarded rather than the proof of damage or other legal requirements in a claim, the review has been limited to the various methods used in determining that amount. Edem (6), in his 1985 research, found that six formulas held the most confidence of the legal and accounting professions. Of these, the Eichleay and the Allegheny have the largest following. However, Edem found that all six had shortcomings in determining an accurate figure for unabsorbed overhead. Table I summarizes Edem's findings.

Table I. Summary of Edem's Findings

EXAMPLE / FORMULA	1	2	3
Allegheny	A	U	U
Eichleay	A	O	O
Carteret	A	A	A*
Allied	U	U	U
A.C.E.S.	A	A	O
Simulation	A	O	O

A = Accurately calculates unabsorbed overhead

U = Understates unabsorbed overhead

O = Overstates unabsorbed overhead

* Edem found that the Carteret Formula fails when confronted with changing overhead rates though this was not included as one of his examples (6:125).

(Extracted from source 6:52,66,80,124-128)

Edem was hoping to develop a formula that would accurately represent unabsorbed overhead. While he was unable to develop this formula, he did show that each of the six main formulas, and more significantly the two most popular, are inaccurate. Clearly, follow-on research was needed to complete the task.

III. Methodology

Method

Since this research is continuing the study conducted by Timothy Edem in 1985, similar methods will be used here. Edem built a very simple example of a delayed government contract and then incrementally complicated the situation. In this way, he takes the simple example and familiarizes the reader with the subject and concepts. By incrementally complicating the example, he maintains the ease of understanding of the simple example and makes each successive example more general in nature: more illustrative of the real world. While unable to develop a formula for use in more general delay situations, he did prove that each of the commonly used formulas do not accurately compute unabsorbed overhead in two of his three relatively simple examples. It is inconceivable that these formulas could be accurate in the much more complex real world. Edem also claims that extending his experiment one more increment would leave us with a completely generalized formula that could be used in all cases of delayed contracts. This experiment will continue using Edem's basic method and his three examples (see Chapter II). Developing one more example will allow for the theoretical implication which is the completely generalized formula which is being sought.

Evaluation

Once a formula is developed, it will be tested against Edem's three examples, to demonstrate continuity of procedures, and against the two most popular formulas, the Allegheny and the Eichleay. A simple comparison of results using the new formula versus Edem's results in his three examples will be the first evaluation. In each of the three examples, Edem has computed the "true" unabsorbed overhead. The result from the new formula will be compared with these figures. A further test will be conducted against other situations as a test of the formulas versatility. Finally, the new formula will be used on the example presented in the Defense Contract Audit Agency (DCAA) pamphlet, Audit Guidance Delay and Disruption Claims (5). Here, comparisons will be made between the new formula and DCAA's computations of unabsorbed overhead. From these comparisons, a conclusion should be evident concerning the accuracy of the Allegheny and Eichleay Formulas as well as the new formula proposed in this research.

Legal Basis

While this thesis does not address the "entitlement" question, some discussion of a legal concept that is inextricably interwoven with the question of quantum, or amount of award, is required. This will establish the basis for what is viewed as the Government's liability in unabsorbed overhead cases for the purpose of this thesis.

One of the tenets of contract law is that the injured party be made whole--that is, he is to be returned to a condition so that he is as well off as he was before the breach of contract. This concept has its basis in the Restatement of Law, Contracts Section 329 which states:

> In awarding compensatory damages, the effort is made to put the injured party in as good position as that in which he would have been put by full performance of the contract.... (11:1372)

In cases involving government caused delays, the contractor is the injured party. Paul M. Trueger in his text, Accounting Guide for Government Contracts, states:

> Equitable adjustments to 'make the contractor whole' must include specifically identified direct and indirect costs, and the additional indirect expenses variously termed 'unabsorbed overhead' and 'extended overhead'. (13:v)

The courts have supported this view. In Bruce Construction Corp. v. U.S.,

> ...the Court of Claims said that the basic purpose of the equitable price adjustment is 'to keep the contractor whole' when the Government modifies a contract. (13:95)

The Government frequently argues, and some see an intrinsic worth in this argument, that overhead is something that is an ongoing cost of business and will be incurred whether the contract is delayed or not and therefore should not be paid for by the government. This view has been repudiated by the boards and courts. In a case heard by the Armed Services Board of Contract Appeals (ASBCA) in 1984, they found in favor of George E. Jensen Contractor, Inc., stating:

> ...the Government argues that the home office or

> extended overhead costs are fixed costs which would have been incurred even if there had been no delay.
>
> This argument misses the point. Home office overhead expenses are indirect costs usually allocated to all of a contractor's contracts based upon each contract's incurred direct costs. When a Government caused delay causes a contractor's direct costs to decline greatly, that contract does not receive its fair share of the fixed home office expenses. (9:89252)

In a 1985 case heard by the Corps of Engineers Board of Contract Appeals (ENG BCA), the board stated:

> The manifest unfairness of keeping a contractor engaged on, or liable to perform, a job but postponing or extending his performance well beyond what he had a right to expect and upon which he bid, demands a means of compensating him for his costs of operating his home office during such extended period. (8:89354)

Appeals to the Federal Courts have met with similar results. In the final decision of the Capital Electric Case (3), the U.S. Court of Appeals for the Federal Circuit found in favor of Capital. In a concurring opinion, Judge Friedman elaborated on the logic of the decision:

> A contractor's estimate of its costs necessarily includes its overhead costs, which it calculates on the basis of the time required to perform the contract. Where performance of a contract has been delayed, the overhead expenses of performing that contract continue for the additional time. A portion for the total overhead for that additional period accordingly is allocable as a cost of performing that contract. (3)

The intent of the court and board decisions is clearly evident and summarized quite well by Ralph C. Nash, Jr. and John Cibinic, Jr. in their text, Federal Procurement Law, Volume II, where they state:

> It appears that in most cases, the award of

> unabsorbed overhead is intended to compensate the contractor for fixed overhead at **essentially the same rate** as he had anticipated charging to the contract. (11:1409) (Emphasis added)

It is in this sense that this thesis proceeds: the equitable solution will make the contractor "whole."

IV. Formula Development

Introduction

In Edem's 1985 research, he used three simple situations in developing his analysis of the commonly used methods of computing unabsorbed overhead. In this chapter, a new, more generalized situation will be presented. This new example will be analyzed to determine the government's share of delay period overhead and then compared to the Allegheny and the Eichleay solutions. (Edem used the term "true" unabsorbed overhead in his examples which emphasized the inaccuracies of the various formulas in use. Since not all unabsorbed overhead is necessarily attributable to the Government, the phrase "government's share" will be used here.) A formula based on the concept of "making the contractor whole" will be developed. This will calculate the government's share of delay period overhead and be generalized such that it can be used in a variety of situations without bias for or against the Government.

Example 4

The basic outline of this example is suggested in Edem's research (6:126-127). The government contractor in this case has three employees and has another contract (not necessarily a government contract) in progress during the entire period. Each of the three employees is paid a different hourly wage. The government contract in question (Contract 1 in this example) is for 100 days, and the fixed

overhead for the business as a whole is $300 per day. Two employees are assigned to Contract 1 and paid $7 and $6 per hour. The third employee is assigned to the other contract (Contract 2) and paid $8 per hour. A government caused delay of 15 days occurs during the performance of Contract 1. Of these 15 days, Replacement Work for 1 employee is found for 9 days at $5 per hour. The contractor uses direct labor dollar as his allocation base for overhead. Before analyzing this example, the concept of "government's share" requires exploration.

Conceptual Analysis

In the spirit of the legal precedents discussed in Chapter III, the goal here is to "make the contractor whole"--that is, to reimburse the contractor for overhead left unabsorbed by virtue of the delay in the government contract. However, the Government is not a charitable organization so there is no intention to assign responsibility to the Government where it is clearly not liable. The Government is clearly not liable for all unabsorbed overhead in two general situations. The first situation is when the contractor is in an underabsorbtion position of his own making and the second is when the contractor has substituted sufficient other work to cover a portion or the whole of the government's delayed contract overhead. The challenge here is to first determine what is the government's share of the contractor's overhead and then

determine what other, if any, contractor activity would relieve the Government from the liability of that overhead.

Two questions arise when analyzing this example. First, what is the "normal level of business" for the contractor and what effect does it have on unabsorbed overhead? And second, is Replacement Work identifiable as such or are aggregate figures the best that can be expected?.

The "normal level of business" can have an effect on amount and computation of the amount of unabsorbed overhead. For example, suppose the contractor is in a position where the "normal" level is greater than that occurring during the contract period and the delay. Since contracts will likely be bid at an overhead rate based on a normal level of activity, this puts the firm in an underabsorbing position--that is, there is more overhead expense actually being incurred than is being allocated, or absorbed. In this situation there is unabsorbed overhead in existence even during the contract period. While this unabsorbed overhead may continue into the delay period, it is a situation of the contractor's own making and that portion should not be reimbursed by the Government. The converse situation is where the contractor is in an overabsorbing position--where a contractor is allocating more overhead to the various jobs ongoing during the contract period than is actually being incurred. There is nothing ominous or illegal with such situations; they are merely possibilities

in a fluctuating business environment. Since the overhead rate is probably based on a yearly projection of what overhead costs and direct labor (the allocation base) will be, it is unlikely that at any given time the actual labor base will equal the normal level, and therefore absorbed overhead will not equal the actual overhead incurred. These situations present challenging twists to the computational problem of determining government's share of delay period overhead. Both the underabsorbed and overabsorbed situations must be addressed in any truly generalized solution.

Since the allocation (absorbtion) of overhead is dependent on the "normal level" of business activity, how is this level determined? There are a number of techniques that could conceivably be used to determine a "normal level." One that has already been mentioned is using yearly projections or averages for overhead and the allocation base. This method could be modified to use the average over the extended contract period or 6 months either side of the delay period or whatever period seems reasonable. These methods should have similar results. The longer periods have the advantage of dampening the ebbs and flows of business while the shorter periods, centered around the delay period, have the advantage of using cost information more relevant to the delay period. The Allegheny and the Eichleay Formulas both use cost information relevant to the delay extended contract period (13:114,118). The longer

periods would more likely provide a more consistent computation of "normal." Peculiarities in industries, location, or the general economic conditions could be justifiably argued. This will require a determination by the parties involved.

The second point of concern is the capability to identify any Replacement Work undertaken by the contractor during the delay period. The question of whether or not a contractor had obtained or was capable of obtaining Replacement Work is one more directly related to "entitlement" rather than "quantum." Where it enters into the quantum determination process is that this work serves to absorb some overhead. Since, by definition, Replacement Work is using resources that would be committed to the government contract were it not for the delay, it would be double absorbtion for both the Replacement Work and the Government to pay for that portion of the overhead. Specifically identifying the overhead allocation base (and computing the overhead allocated) in jobs that constitute Replacement Work could prove impossible if the contractor has an accounting system that is unable to track labor costs (or another allocation base) by individual job. Consequently, it becomes necessary to use aggregate figures for the delay period labor base instead of specifically identifying the overhead properly allocated to the Replacement Work. Aggregate figures for direct labor or other allocation base on either a daily, monthly, or

quarterly basis should be available. This lack of ability to specifically identify Replacement Work must also be taken into account in any generalized formula.

Example 4 Expanded

Looking back to the new example, it is evident that to get a truly generalized formula, more than just one example will have to be analyzed. While Example 4 provides the complexity of continuing contracts, differing labor rates and limited Replacement Work, it lacks the underabsorbtion/overabsorbtion aspect that could dramatically impact any unabsorbed overhead computation. To correct for this, two variations of Example 4 will be added so that there are now three cases of Example 4. All cases will have the same general circumstances, as previously described, with the following specifics:

Case 1: Normal business level is $168 direct labor per day ($7/hr + $6/hr +$8/hr times 8 hrs/day). With daily overhead of $300, the overhead rate is 178.57% ($300/$168) as originally presented.

Case 2: Normal business level is determined to be $184 direct labor per day with a resulting overhead rate of 163.04% ($300/$184). This is the underabsorbtion position.

Case 3: Normal business level is determined to be $155 direct labor per day with a resulting overhead rate of 193.55% ($300/$155). This is the overabsorbtion position.

Each of these different cases provide unique situations that must be dealt with in a generalized formula. Case 1 is the simplest and would be easiest to understand. A formula

developed from this case would be more comparable to the Allegheny and Eichleay formulas since neither of those address the underabsorbtion/overabsorbtion positions. The formula development here, however, will recognize the necessity to be able to handle these other cases.

Case 1 Analysis. From the situation described for Case 1 a few simple calculations can be made to determine the amount of overhead left unabsorbed by the government caused delay. The total amount of overhead for the delay period is $4500 ($300 per day times 15 days). The total direct labor dollar per day during the contract period is $168. The overhead rate is the daily overhead divided by the normal level allocation base, or $300 divided by $168 which equals 178.57% of each direct labor dollar. The overhead absorbed during the delay period can be determined by calculating an average daily direct labor cost for the delay period and then multiplying by the overhead rate. During the 6 days of no Replacement Work, the direct labor amounts to $8 per hour wage times 8 hours per day times 6 days of no Replacement Work. This amounts to $384. During the 9 days of replacement work, the direct labor is $13 per hour wage ($8 Contract 2 and $5 Replacement Work) times 8 hours per day times 9 days or $936 for a total direct labor during the delay of $1320 ($384 plus $936). The total overhead absorbed during the delay period is $2357 ($1320 times 178.57%). Note, in this example, there is an assumption

that delay activity can be segregated into normal non-contract activity and Replacement Work. As discussed earlier in this chapter, such a segregation may not be practicable. The distinction is made here for the purpose of clarifying this example only. Only the average daily labor activity during the delay period needs to be known. This is true also for the Allegheny and the Eichleay Formulas. The above determination of quantum can be readily computed using the average delay period daily labor. Dividing the delay period total labor of $1320 by the 15 days of delay gives a average delay period daily labor figure of $88. By applying the normal overhead rate of 178.57% for 15 days of delay to the average delay period daily labor ($88 X 178.57% X 15 days) the figure of $2357 is computed for the amount of overhead absorbed during the delay period. Subtracting this figure from the total overhead for the delay period ($4500) gives the amount of overhead that is unabsorbed ($2143). Since the reduction in activity during the delay ($168/day pre-delay to $88/day during the delay) is attributable solely to the government contract, the $2143 unabsorbed overhead figure is properly charged to the Government under the premise of " making the contractor whole." Now that the government's share of unabsorbed overhead is known, it can be compared to the Allegheny and Eichleay Formulas.

The Allegheny Formula. The following calculations are necessary for using the Allegheny Formula (See Chapter II,

page 2-2, for background on the formula):

Total Overhead for Contract Period plus Delay = $\frac{\$300}{\text{day}}$ X 115 days = $34500

Total Direct Labor Dollar for Contract Period plus Delay
- Employee 1 $7/hr X 8 hr X 100 days
- Employee 2 $6/hr X 8 hr X 100 days
- Employee 3 $8/hr X 8 hr X 115 days
- Employee 1 $5/hr X 8 hr X 9 days = $18120

Incurred Overhead Rate for the *Projected Contract Period* ($300 Daily Overhead -:- $168 Actual Labor Base During Projected Contract Period) = 178.57%

Allocation Base in Contract
- Employee 1 $ 7/hr
- Employee 2 6/hr

$13/hr X 8 hr/day X 100 days = $10400

Actual Overhead Rate Experienced for Total Time Period Including Delay

Total Overhead Including Delay -:- Total Direct Labor Dollar Including Delay

$34500 -:- $18120 = 190.40%

Substituting these figures into the Allegheny Formula provides the following:

Actual Overhead Rate Experienced for Total Time Period Including Delay	-	Actual Overhead Rate for the Projected Contract Period	=	Rate of Under-absorbtion
190.40%	-	178.57%	=	11.83%

Rate of Under-absorbtion	X	Allocation Base in Contract	=	Unabsorbed Overhead
11.83%	X	$10400	=	$ 1230

(Formula adapted from source 6:15-16)

The Allegheny Formula understates unabsorbed overhead by $913 (the government's share of unabsorbed overhead of $2143 minus the above computation of $1230). This result is consistent with Edem's findings concerning this formula.

The Eichleay Formula. The following calculations are necessary for using the Eichleay Formula (See Chapter II for background on the formula):

Total Contract Price (Contract 1)				
Direct Labor	$10400			
Overhead				
@ 178.57%	18571			
Subtotal		$28971		
Profit--10%		2897		
Total			$31868	
Total Billings for Full Contract Period				
Contract 1 (See above)			$31868	
Contract 2				
Direct Labor	$ 7360			
Overhead				
@ 178.57%	13143			
Subtotal		$20503		
Profit--10%		2050		
Total			$22553	
Replacement Work				
Direct Labor	$ 360			
Overhead				
@178.57	643			
Subtotal		$ 1003		
Profit--10%		100		
Total			$ 1103	
Grand Total				$55524
Indirect Costs for Contract Period				
$300 per day X 115 days				$34500

Substituting the values into the Eichleay Formula yields the following:

Total Contract Price	-:-	Total Billings for Full Contract Period	X	Indirect Costs for Contract Period	=	Indirect Costs Allocable to Contract
$31868	-:-	$55524	X	$34500	=	$19801

Allocable Overhead	-:-	Total Days of Performance	=	Daily Contract Overhead
$19801	-:-	115	=	$172.185

Daily Contract Overhead	X	Days of Delay	=	Indirect Costs Recoverable
$172.185	X	15	=	$2583

(Formula from source 12:86227)

The Eichleay Formula overstates unabsorbed overhead by $440 (the government's share of unabsorbed overhead of $2143 minus the above computation of $2583). This result is also consistent with Edem's findings. Now that the government's share is known and the two most popular formulas shown to be in error, the next step is to devise the new formula.

The Formula

In Example 4, Case 1, the portion of government-responsible overhead during the contract performance period is the percent of contract labor to that level of labor normally occurring in the business, or $104 divided by $168 which equals 61.9%. This is the maximum percentage of the delay period overhead for which the government could reasonably be liable. In order to detect if there is any additional non-contract work conducted during the delay, the percentage

of average daily non-contract labor during the actual period of contract performance to normal daily labor and the percentage of normal daily labor during the delay period to normal daily labor can be compared. In this example, the percentage of average daily non-contract labor during the actual contract performance period to normal daily labor is $64/$168, or $38.1%. The percentage of average daily labor during the delay period to normal daily labor is $88/$168, or 52.4%. If the percentage is higher during the delay period, that indicates that there is an increase of non-contract work during the delay period--Replacement Work may have taken place. In any case, more overhead is being absorbed by non-contract work than was the case previously. The point at which delay period percentage starts to exceed the non-contract percentage that had occurred during the contract performance period is where non-contract work would start to cover the portion of overhead previously covered by the government contract. This point occurs, generally, when non-contract work equals the normal level of labor minus the contract labor. Since all percentages here have normal daily labor as the denominator, they can be mathematically manipulated without worrying about comparing apples and oranges. The difference in non-contract labor (delay period percentage - contract period percentage) is the percentage of delay period overhead that is now being absorbed by non-contract work instead of being a government liability. Subtracting this percentage from the government liability

percentage (Contract Direct Labor/Normal Level Direct Labor) provides the percentage of delay period overhead that is the government's share.

In order to put this into formula form, the process described above must be broken down into clearly defined steps. The first step is to determine the amount of overhead the firm has incurred for the delay period. In this example, it is assumed to be $300 per day for the 15 day delay period, or $4500. This provides one argument for the formula, "Overhead Incurred During Delay Period." The next step is to determine what proportion of overhead is being absorbed during the contract performance period by the government contract and what proportion is being absorbed by other work being conducted by the contractor. Here, the contract is absorbing 61.9% ($104 contract labor -:- $168 normal business level labor) and other work is absorbing 38.1% ($64 non-contract labor -:- $168 normal business level labor). This provides two more arguments for the formula, "Contract Percentage of Direct Labor During Contract Performance Period" and "Non-Contract Percentage of Direct Labor During Contract Performance Period." Next we must determine what level of activity is occurring during the delay period. In this case, there is one contract ongoing throughout the delay period and Replacement Work (RW) is found for 9 of the 15 days of the delay. It may help to draw a timeline in a very complicated or extended delay situation. A timeline for Example 4 is shown in Figure 1.

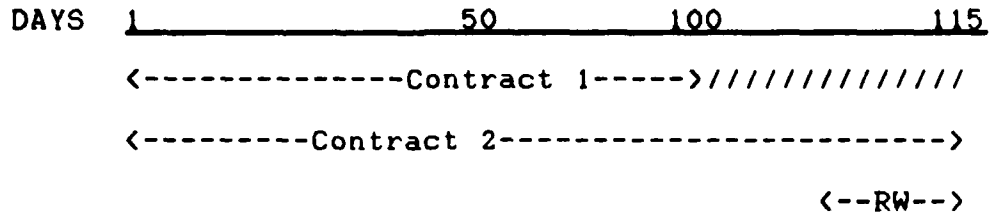

Fig 1. Timeline of Business Activity--
Example 4

From the timeline, it is easy to see that there are two distinct periods of differing levels of business activity. During the first period (6 days), there is only Contract 2 at $64 per day direct labor. During the second period (9 days) there is both Contract 2 and the Replacement Work at $40 per day direct labor. From this, the total direct labor during the delay period can be computed and then divided by the number of delay days to get an average direct labor cost during the delay. This amounts to $88 per day. The average direct labor cost during the delay, as a percentage of the normal activity level of $168 per day, is the amount of overhead absorbed by non-contract work during the delay period, or "Non-Contract Percentage of Direct Labor During the Delay Period." Putting it all together, the formula appears as follows:

Non-Contract Percentage of Direct Labor During the Delay Period	-	Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)

Contract Percentage of Direct Labor During Contract Performance Period	-	Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead

Government's Percentage Share of Delay Period Overhead	X	Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead

Substituting the numbers previously calculated yields the following:

52.4%	-	38.1%	=	14.3%
61.9%	-	14.3%	=	47.6%
47.6%	X	$4500	=	$2142

This is the same amount as computed earlier in this chapter (rounding errors excluded). The formula accurately calculates the government's share of delay period overhead in this case.

In the second portion of the formula above, is a qualifying statement concerning the value of the "Non-Contract Absorbtion Factor." Recall that the "Contract Percentage of Direct Labor During the Contract Performance Period" element represents the maximum amount for which the Government is liable. This leads to the lower limit on the "Factor." Not limiting that factor to the lower limit of zero would inequitably assess the Government for overhead it had absolutely nothing to do with. This would occur, for example, if there was no work being conducted during the

delay period making the value of the "Factor" a negative 38.1. This negative then would be subtracted from "Contract Percentage of Direct Labor During Contract Performance Period" creating an increase in the government's share which is not logical. It is therefore lower limited to zero.

A point of clarification concerning the "Overhead Incurred During the Delay Period" figure is needed. There are a number of costs that may be lumped into a contractor's overhead figure that are normally charged against commercial contracts which are not allowed under Federal procurement regulations. It is necessary to remove any of these costs from the "Daily Overhead" figure. This may add one more step to the formula process if this is indeed the case for any particular delay situation.

Case 2 Analysis

Recall that Case 2 is the same as Case 1 with the exception being that the "normal business level" is $184 direct labor per day. In this case the contractor is underabsorbing overhead, even during the contract performance period. The following figures will be used in the calculation of government's share of unabsorbed overhead (Direct Labor figures on a daily basis):

Total Delay Period Overhead	$4500
Normal Business Level--Direct Labor	$ 184
Contract 1 Direct Labor (Contract Period)	$ 104
Contract 2 Direct Labor (Contract Period)	$ 64

Contract 2 Direct Labor (Delay Period)	$ 64
Delay Period	15 days
Replacement Work Days (@ $40 per day)	9 days
Average Replacement Work Direct Labor (for the 15 day delay period)	$ 24
Average Direct Labor--Delay Period	$ 88
Overhead Rate	163.04%

The overhead absorbed during the delay period is the Average Direct Labor during the delay times the Overhead Rate times the number of days delay. This equals $2152. In this case, there is an amount of overhead that was not being absorbed during the contract period and continues unabsorbed through the delay. This is represented by the difference between the normal business level, $184 per day, and the $168 per day that the company was operating at during the contract performance period, or $16 per day. Multiplying this number by the number of delay days (15) and the overhead rate (163.04%) gives $391 of overhead that continues to be unabsorbed during the delay period through no fault of the Government. Subtracting all of the absorbed overhead and the overhead left unabsorbed for reasons other than government caused delay will leave the amount of overhead for which the Government is responsible. In this case, the amount of government overhead responsibility is $1957 ($4500 - $2152 - $391).

Using the formula developed earlier in the chapter to

figure the government's share of unabsorbed overhead looks like this (See below for the formula):

Contract Percentage of Direct Labor During Contract Performance Period ($104 -:- $184)	56.5%
Non-Contract Percentage of Direct Labor During Contract Performance Period ($64 -:- $184)	34.8%
Non-Contract Percentage of Direct Labor During the Delay Period ($88 -:- $184)	47.8%

Substituting the numbers previously calculated yields the following:

Non-Contract Percentage of Direct Labor During the Delay Period		Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)
47.8%	-	34.8%	=	13.0%

Contract Percentage of Direct Labor During Contract Performance Period		Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead
56.5%	-	13.0%	=	43.5%

Government's Percentage Share of Delay Period Overhead		Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead
43.5%	X	$4500	=	$1958

Ignoring the rounding effect, these two methods are the same. The new formula is accurate in this situation.

The Allegheny and Eichleay Formulas. Studying the two formulas reveals that neither one of these formulas are sensitive to different levels of operating activity. The results for this case are the same as Case 1 (Allegheny = $1230; Eichleay = $2583). This leaves the Allegheny understating the government share by $728 and the Eichleay overstating the government's share by $625. Again, both these results are in agreement with Edem's findings.

Case 3 Analysis

Case 3 is the opposite of Case 2; here the firm is in an overabsorbing position during the period of contract activity. This position presents a dilemma in the determination of an equitable position. The dilemma is: should the Government be held responsible for delay period overhead at the same percentage as occurred in the contract period even if this means the firm would be allocating more overhead than actually incurred; or, should the Government take full advantage of the overabsorbing position and reimburse only up to the normal business level; or, should there be some sort of a compromise between the two positions? The following figures will help the analysis (Direct labor figures on a daily basis):

Total Delay Period Overhead	$4500
Normal Business Level Direct Labor	$ 155
Contract 1 Direct Labor (Contract Period)	$ 104

Contract 2 Direct Labor (Contract Period)	$ 64
Contract 2 Direct Labor (Delay Period)	$ 64
Delay Period	15 days
Replacement Work Days (@ $40 per day)	9 days
Average Replacement Work Direct Labor (for the 15 day delay period)	$ 24
Average Direct Labor--Delay Period	$ 88
Overhead Rate	193.55%

The overhead absorbed during the delay period, again, is the Average Daily Direct Labor during the delay times the Overhead Rate times the number of delay days ($88 X 193.55% X 15). This equals $2555. This would leave only $1945 of overhead unabsorbed. Limiting the government's share to this figure would be most advantageous to the Government and penalize the contractor for being fortunate or industrious enough to find work over and above his normal business level during the contract performance period. This solution does not seem to "make the contractor whole." Limiting the government liability in this fashion has taken a business boom of the contractor's own making and turned it into a "normal business level" period. An alternative solution is to continue the allocation of overhead at the same rate as in the contract less the amount allocated to Replacement Work. The overhead left unabsorbed by the contract is $3019 ($104/day X 193.55% X 15 days) and the overhead absorbed by the Replacement Work is $697 ($40 X 193.55% X 9 days). Subtracting Replacement Work from the overhead left

unabsorbed by the contract gives $2322 ($3019 - $697). This solution allows the brunt of the delay to fall on the Government. It does, however, return the contractor to the level of business that was actually occurring at the time of the delay, "making the contractor whole." A middle ground solution could be found by using some ratio or an average of the two solutions above. This solution would have all the drawbacks mentioned above and none of advantages. It wouldn't return the contractor to pre-delay status nor would it eliminate the overabsorbtion. Further, there is no legal basis for such a solution. Going back to the philosophy of "making the contractor whole," the solution seems to be the one that continues the allocation at the contract rate, as Nash (11:1409) suggested, and subtracting the Replacement Work overhead. This does return the contractor to a level of business that, in fact, was occurring during the contract period. It would be inequitable to do otherwise. Therefore, the government's share of unabsorbed overhead in this case is $2322.

Using again the formula developed earlier in the chapter, the government's share of unabsorbed overhead looks like this:

Contract Percentage of Direct Labor During Contract Performance Period ($104 -:- $155)	67.1%
Non-Contract Percentage of Direct Labor During Contract Performance Period ($64 -:- $155)	41.3%

Non-Contract Percentage of Direct Labor During the Delay Period ($88 -:- $155)	56.8%

Substituting the numbers previously calculated yields the following:

Non-Contract Percentage of Direct Labor During the Delay Period	-	Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)
56.8%	-	41.3%	=	15.5%

Contract Percentage of Direct Labor During Contract Performance Period	-	Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead
67.1%	-	15.5%	=	51.6%

Government's Percentage Share of Delay Period Overhead	X	Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead
51.6%	X	$4500	=	$2322

Again, the new formula has successfully calculated the government's share of unabsorbed overhead.

The Allegheny and Eichleay Formulas. Again, these two formulas are not sensitive to changes in the normal business level so their solutions remain $1230 and $2583, respectively. This means that the Allegheny understates by $1093 and the Eichleay overstates by $260. These results are in agreement with Edem's findings.

Summary

In this chapter, a fourth example has been added to Edem's three examples. This new example, as recommended in his research, extends the simplicity of his original example one more step towards the real world. However, it was determined that to more accurately imitate the real world, variations in the new example would have to be studied. The two variations included situations where the contractor is in an overabsorbing position (operating at a higher level of business than normal) and where he is in an underabsorbing position (operating at a lower level of business than normal). With these new complications added, a new formula was developed on the principle of "making the contractor whole." This "Fair Share Formula," as it will be subsequently known, was shown to be accurate in all three variations of Example 4. It has also been shown that the Allegheny and the Eichleay Formulas continue to fall short of the goal of an accurate rendering of unabsorbed overhead. The Allegheny Formula continues to understate the government's share of unabsorbed overhead and the Eichleay Formula continues to overstate the government's share of unabsorbed overhead.

In Chapter V, the Fair Share Formula will be evaluated against Edem's three examples, evaluated at various levels of delay period work and used to calculate the government's share in an example contained in DCAA's pamphlet, Audit Guidance Delay and Disruption Claims (5).

V. Evaluation

Introduction

In Chapter IV, a new formula for computing the government's share of unabsorbed overhead was developed using a follow-on example from the 1985 research of Timothy Edem. This formula, the Fair Share Formula, based upon legal precedents, was also found to be accurate in two variations of that example. In this chapter, the Fair Share Formula will be tested against Edem's original three examples. While simple, these examples envelop the basic concept of unabsorbed overhead and have known solutions. A second evaluation will compare the formula of Chapter IV with the Allegheny and Eichleay methods when various levels of business activity occur during the delay period. Finally, the formula will be applied in a more complete example; the example contained in the DCAA audit manual, Audit Guidance Delay and Disruption Claims (5).

Edem's Examples

Recall that Edem used three very simple examples, each succeeding example slightly more complex than the one preceding it. With these basic examples, he was able to calculate the government's share of unabsorbed overhead and show that, generally, the Allegheny Formula understates government liability while the Eichleay Formula overstates that liability. The specifics of each example and a comparison with the Fair Share Formula follows.

Example 1. Example 1 is a contractor with one employee. The contractor has just the one contract. During a government caused delay, the contractor is unable to find any Replacement Work for the firm (6:38). The following figures are excerpted from Edem's work:

Delay Period Overhead (Total Overhead minus Contract Overhead)	=	$11,200
Daily Contract Direct Labor (Contract Period)	=	$ 56
Daily Non-Contract Direct Labor (Contract Period)	=	$ 0
Average Daily Delay Period Direct Labor	=	$ 0
Edem Calculated "True" Unabsorbed Overhead (Government's Share)	=	$11,200
Eichleay Formula Result	=	$11,200
Allegheny Formula Result	=	$11,200

(Excerpted from source 6:38-39,42,45)

There is one additional piece of information that is needed to use the Fair Share Formula--normal business level. In the absence of any yearly data here, it will be assumed that the "normal" is for the contractor to keep the employee working and therefore the normal is the $56 per day employee wage. Edem implicitly used a full employment assumption in figuring his contract overhead rate (6:39); so the assumption here is consistent with Edem. Below, the Fair Share Formula is repeated for convenience.

Non-Contract Percentage of Direct Labor During the Delay Period	-	Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)
Contract Percentage of Direct Labor During Contract Performance Period	-	Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead
Government's Percentage Share of Delay Period Overhead	X	Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead

A review of how each entering argument is derived is appropriate here.

Contract Percentage of Direct Labor During Contract Performance Period	=	Daily Contract Direct Labor (During Contract) -:- "Normal" Daily Direct Labor
Non-Contract Percentage Of Direct Labor During Contract Performance Period	=	Daily Non-Contract Direct Labor (During Contract) -:- "Normal" Daily Direct Labor
Non-Contract Percentage Of Direct Labor During Delay Period	=	Average Daily Delay Direct Labor -:- "Normal" Daily Direct Labor

The calculations for this example appear below.

Contract Percentage of Direct Labor During Contract Performance Period	=	$\frac{\$56}{\$56}$	=	100.0%
Non-Contract Percentage of Direct Labor During Contract Performance Period	=	$\frac{0}{\$56}$	=	0.0%

Non-Contract Percentage of Direct Labor During the Delay Period	=	$\frac{0}{\$56}$	=	0.0%

Substituting these figures into the Fair Share Formula gives

Non-Contract Percentage of Direct Labor During the Delay Period	-	Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)
0.0%	-	0.0%	=	0.0%

Contract Percentage of Direct Labor During Contract Performance Period	-	Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead
100.0%	-	0.0%	=	100.0%

Government's Percentage Share of Delay Period Overhead	X	Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead
100.0%	X	$11,200	=	$11,200

So in this example, the Fair Share Formula as well as the Allegheny and Eichleay Formulas correctly calculated the government's share of unabsorbed overhead. This is not surprising considering the simplicity of the situation. The next example is slightly more complex.

Example 2. This example is a duplicate of the first except that the firm was able to find Replacement Work for one-half the delay period, or 40 work days at the same

direct labor rate as occurred in the contract. The employee was laid off during the remainder of the delay period (6:53). The pertinent figures appear below.

Delay Period Overhead (Total Overhead minus Contract Overhead)	=	$11,200
Daily Contract Direct Labor (Contract Period)	=	$ 56
Daily Non-Contract Direct Labor (Contract Period)	=	$ 56
Average Daily Delay Period Direct Labor ($56 per day times 40 days work divided by 80 delay days)	=	$ 28
Edem Calculated "True" Unabsorbed Overhead (Government's Share)	=	$ 5,600
Eichleay Formula Result	=	$ 8,960
Allegheny Formula Result	=	$ 4,480

(Excerpted from source 6:53-54,56,59)

Again, the assumption of "normal" business level of $56 per day is made. The entering arguments for the Fair Share Formula appear below.

Contract Percentage of Direct Labor During Contract Performance Period	=	$56 / $56	= 100.0%
Non-Contract Percentage of Direct Labor During Contract Performance Period	=	0 / $56	= 0.0%
Non-Contract Percentage of Direct Labor During the Delay Period	=	$28 / $56	= 50.0%

Substituting these figures into the Fair Share Formula gives

Non-Contract Percentage of Direct Labor During the Delay Period	-	Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)
50.0%	-	0.0%	=	50.0%

Contract Percentage of Direct Labor During Contract Performance Period	-	Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead
100.0%	-	50.0%	=	50.0%

Government's Percentage Share of Delay Period Overhead	X	Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead
50.0%	X	$11,200	=	$ 5,600

Here, the Fair Share Formula correctly calculated the government's share of unabsorbed overhead while the Allegheny Formula overstated and the Eichleay Formula understated that share. The third, and last of Edem's examples, adds still more complexity to the situation.

Example 3. In Edem's third example, the contractor has two employees, both working on the government contract. During the 80 day delay, one employee is laid off for the entire period while the other is laid off for one-half the period (40 days) and works the other half on Replacement Work. When the employees are working they are paid at a

daily rate of $56 (6:67-68). The specific figures are charted below.

Delay Period Overhead (Total Overhead minus Contract Overhead)	=	$11,200
Daily Contract Direct Labor (Contract Period) (Two employees times $56 per day)	=	$ 112
Daily Non-Contract Direct Labor (Contract Period)	=	$ 0
Average Daily Delay Period Direct Labor (One employee times $56 per day times 40 days work divided by 80 delay days)	=	$ 28
Edem Calculated "True" Unabsorbed Overhead (Government's Share)	=	$ 8,400
Eichleay Formula Result	=	$ 9,956
Allegheny Formula Result	=	$ 7,467

(Excerpted from source 6:67-69,70,73)

Here, the assumption of "normal" business level is increased to $112 per day. Again, this is consistent with Edem's determination of overhead rate for this example. The entering arguments for the Fair Share Formula appear below.

Contract Percentage of Direct Labor During Contract Performance Period	=	$\frac{\$112}{\$112}$	= 100.0%
Non-Contract Percentage of Direct Labor During Contract Performance Period	=	$\frac{0}{\$112}$	= 0.0%
Non-Contract Percentage of Direct Labor During the Delay Period	=	$\frac{\$ 28}{\$112}$	= 25.0%

Substituting these values into the Fair Share Formula gives

Non-Contract Percentage of Direct Labor During the Delay Period	-	Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)
25.0%	-	0.0%	=	25.0%

Contract Percentage of Direct Labor During Contract Performance Period	-	Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead
100.0%	-	25.0%	=	75.0%

Government's Percentage Share of Delay Period Overhead	X	Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead
75.0%	X	$11,200	=	$ 8,400

For this third example, the Fair Share Formula again correctly calculates the government's share of unabsorbed overhead while the Allegheny remains below and the Eichleay remains above.

Comparison of Edem's Formula to the Fair Share Formula. It is not entirely coincidental that Edem's final formula (6:107) and the Fair Share Formula developed in Chapter IV produce the same results. In fact, Edem's Formula is a special case of the more pervasive new formula. This can be seen easily by using algebraic notation.

Let

C0 = Normal Level Daily Direct Labor

C1 = Daily Contract Direct Labor During Contract Performance Period

C2 = Average Daily Direct Labor During Delay

C3 = Average Daily Non-Contract Direct Labor During Contract Performance Period

(Adapted from source 6:83)

In each formula, the last step is multiplying the government's percentage share times the overhead incurred during the delay period. This portion of both formulas need not be algebraically compared. Combining the first two equations of the Fair Share Formula, it can be expressed as follows:

$$\frac{C1}{C0} - \left(\frac{C2}{C0} - \frac{C3}{C0}\right)$$

(lower limit=0)

Edem's Formula expressed in words is

$$1 - \frac{\text{Average Daily Delay Period Direct Labor}}{\text{Average Daily Direct Labor During Contract Performance Period}}$$

(Source 6:83,107)

Expressing this formula in algebraic notation

$$1 - \frac{C2}{C0}$$

Recalling Edem's examples, in each of those cases the "Daily

Contract Direct Labor During the Contract Performance Period" (C1) was assumed to be "normal" and therefore equal to CO. Further, the only work being conducted during the contract performance period was the contract in question. Therefore, C3, "Daily Non-Contract Direct Labor During Contract Performance Period" equals zero. Substituting these equalities into the Fair Share Formula gives the following:

$$\frac{CO}{CO} - \left(\frac{C2}{CO} - \frac{0}{CO}\right)$$
(lower limit=0)

Which reduces to

$$1 - \frac{C2}{CO}$$

Which is the same as Edem's Formula. Edem's Formula is a special case formula that must have the specific requirements mentioned above to be able to compute the government's share of delay period overhead.

Summary of Results. For all three examples developed by Edem, the Fair Share Formula accurately computes the government's share of the delay period overhead. The two formulas favored by the government and the courts fail in this regard and Edem's formula was shown to be a special case of the more general formula developed in Chapter IV. While these results are encouraging, further testing in a wider range of circumstances is required. The next set of

situations will widen the test range.

Additional Aspects of the Fair Share Formula

There are three distinct delay period activity regions for this formula. These three areas' boundaries are defined by the value of the "Non-Contract Absorbtion of Contract Overhead Factor." From studying the Fair Share Formula, certain relationships can be ascertained intuitively. For example, as the value of the "Factor" increases, the government share of delay period overhead decreases. Since the factor is lower limited to zero, the maximum government share is represented by the "Contract Percentage of Direct Labor During Contract Performance Period" figure. The "Factor" is zero in situations where the non-contract work performed during the delay is equal to or less than the non-contract work performed during the contract performance period. This is the first region. Again, when the "Factor" is zero, the contractor could not find sufficient replacement work during the delay to begin absorbing overhead that would otherwise have been absorbed by the contract. To make the contractor whole, the contractor is entitled to the delayed contract's share of the overhead during the delay period.

The second region can be located by looking at the algebraic expression and the "Factor" in particular (the "Factor" is the portion within the parentheses). It is evident that as long as C2 (Average Daily Direct Labor

During the Delay) is equal to or less than C3 (Average Daily Non-Contract Direct Labor During Contract Performance Period), that factor will be zero. This means that there must be some increase in the non-contract work during the delay period for the government's share to be decreased. This will occur when C2 is greater than C3 and reduce the government share by the overhead allocation rate times the amount C2 exceeds C3. In this region, the government's share will be decreasing as more delay period work is obtained.

The third region is where the government's share is zero. From examining the algebraic formula, it is evident that this will occur when C2 exceeds C3 by the amount C1 (Daily Contract Direct Labor During Contract Performance Period); in other words, when delay work exceeds the non-contract work during the contract performance period by the amount of the contract. In such a situation, the contractor found Replacement Work during the delay which completely absorbed overhead that the contract would have otherwise absorbed. So, the contractor's initiative has made him whole and there is no government liability. Conceivably, C2 could exceed C3 by more than the C1 amount. This would create a situation where the government's share is negative; the contractor would owe the government for the government caused delay. While this may make some contracting officers' eyes light up, that particular situation is not likely to occur and, even if it did, would

surely not stand the test in appeals. This would seem to add another limit to the Fair Share Formula: lower limiting the "Government's Percentage Share of Delay Period Overhead" to zero.

In order to demonstrate the formula's response to changes in delay activity, Example 4, Case 1 will be used. Again, the algebraic variables and formula will be used. In Example 4, Case 1 the variables have the following values:

C0 =	Normal Level Daily Direct Labor	= $168
C1 =	Daily Contract Direct Labor During Contract Performance Period	= $104
C2 =	Average Daily Direct Labor During Delay	= $"X"
C3 =	Daily Non-Contract Direct Labor During Contract Performance Period	= $ 64

In this example, the value of C2 will be varied to demonstrate the characteristics of this formula. The algebraic formula appears below:

$$\frac{C1}{C0} - \left(\frac{C2}{C0} - \frac{C3}{C0}\right)$$
(lower limit=0)

Substituting the values from above gives

$$\frac{\$104}{\$168} - \left(\frac{\$"X"}{\$168} - \frac{\$\ 64}{\$168}\right)$$
(lower limit=0)

For demonstration purposes, assume that the values shown above are fixed except for "X." Varying the value of "X" (C2) will demonstrate the characteristics of this formula.

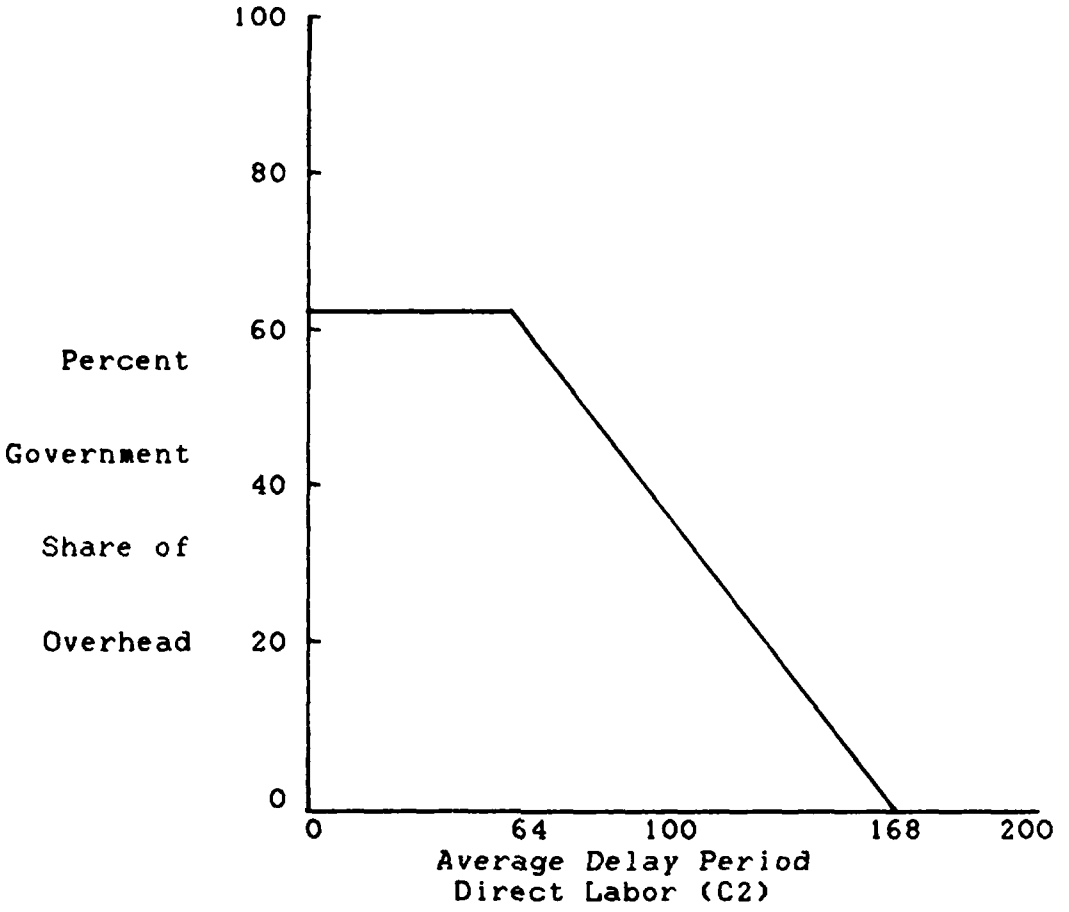

Fig 2. Government Share of Overhead
vs
Average Daily Delay Period Direct Labor
(Not to Exact Scale)

As "X" increases from zero to $64, the value of the "Factor" (the portion in the parentheses) remains at zero due to the lower limit placed upon it. This will leave the government's percentage share fixed for this range of "X" values at $104/$168 (61.9%). As "X" increases beyond $64, the value of the factor is positive and subtracted from 61.9% thereby reducing the government's percentage share. As the value of the "Factor" continues to increase, it will

decrease the government's percentage share. This occurs as "X", Average Daily Direct Labor During the Delay Period (C2), increases from $64 to $168 per day. It is at the point that "X" equals $168 that the value of the "Factor" is equal to the maximum government share thus cancelling that share out and making the government's share zero. Any increase in "X" beyond $168 will result in a government share of zero. Figure 2 provides a graphical representation of the formula's response to a variation of this type. While the amounts listed on the graph are for Example 4, Case 1 in particular, the shape of the graph is typical of any situation. The government's share will start at the percentage of contract direct labor to normal direct labor, remain constant until delay period labor equals non-contract labor during the contract performance period, and then drop on a diagonal line to zero at the point where delay period labor equals non-contract labor plus contract labor during the contract performance period. Now that the character-.stics of the Fair Share Formula are known, a comparison with the Allegheny and Eichleay Formulas is appropriate.

Comparison of the Allegheny, Eichleay and Fair Share Formulas. Neither the Allegheny nor the Eichleay Formulas are as predictable as the Fair Share Formula. Table II shows the various percentages of delay period overhead that each formula calculates using the example above and the various values of delay period direct labor as shown.

TABLE II

Comparison of Three Formulas Calculated Results

Average Delay Period Direct Labor $	Percent of Delay O/H Calculated By Allegheny	Percent of Delay O/H Calculated By Eichleay	Percent Delay O/H Calculated By Fair Share
0	61.9	61.9	61.9
64	36.3	58.6	61.9
70.1	34.0	58.3	58.3
88	27.3	57.4	47.6
104	21.6	56.6	38.1
168	0.0	53.8	0.0

There are several observations that can be made concerning the data in Table II. First, all formulas correctly calculate the government's share of delay period overhead in the situation where delay direct labor is zero. This situation is equivalent to Edem's simplest example, where both the Allegheny and Eichleay correctly calculated the government's share. A second observation concerns the rate of change in each formula. The Allegheny drops off in a rather steep slope to zero at $168. The Eichleay on the other hand drops a mere 8.1%. At the point where there is no government share, both the Allegheny and the Fair Share Formula correctly calculate the zero, while the Eichleay computes a whopping 53.8%. This situation is depicted in Figure 3.

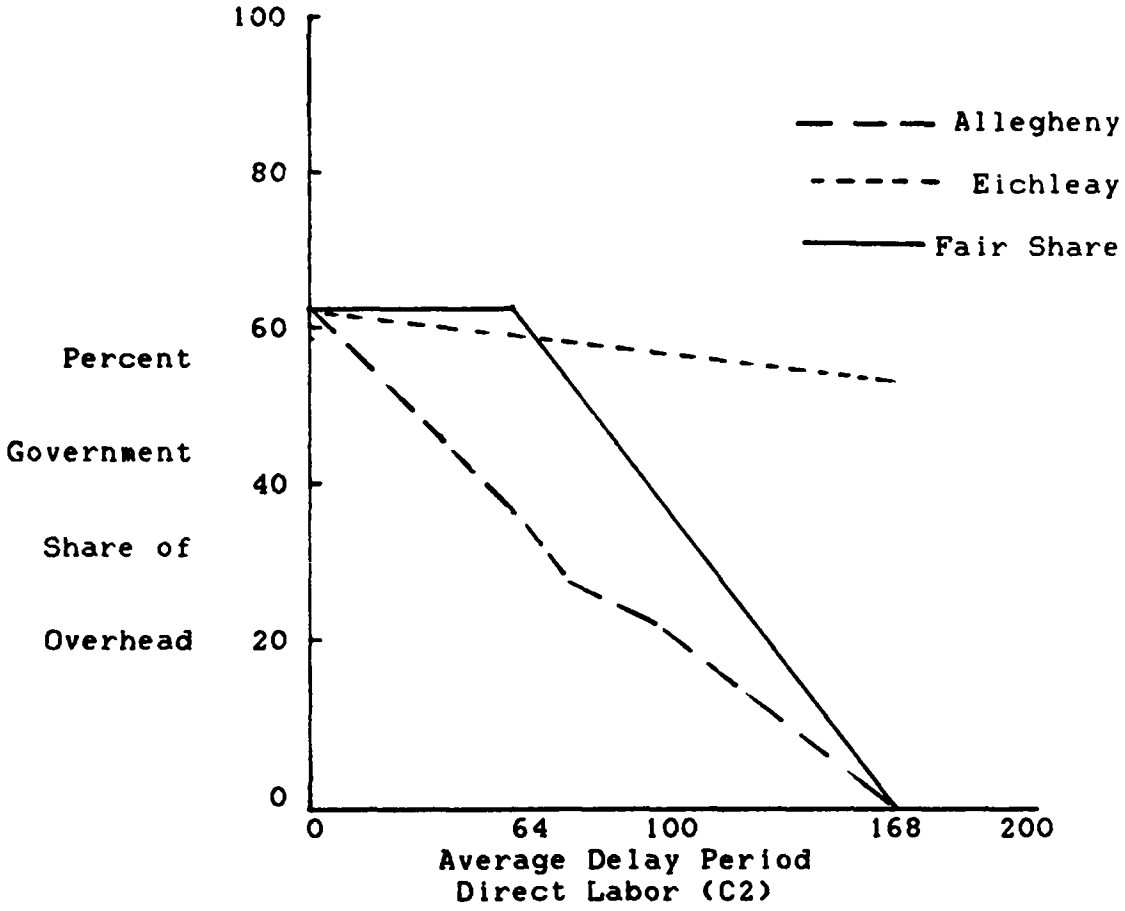

Fig 3. Government Share of Overhead vs. Average Daily Delay Period Direct Labor as Calculated by the Allegheny, Eichleay, and Fair Share Formulas (Not to Exact Scale)

While the Fair Share Formula does remain slightly above the Eichleay for a small range of delay period values, the largest difference is when average daily delay period direct labor is $64. Then the difference is only 3.3 percentage points. As contract replacement work is found, this difference decreases until there is no difference when daily delay period average labor is $70.1 (i.e. the break even point). In such a case as this, where contract period

activity is considered normal activity, a formula for the Eichleay break even point can be described. Two ratios are involved: a) average daily non-contract activity during the extended contract period, divided by average daily total activity during the extended contract period; and, b) average daily delay activity divided by average daily total activity during the period of contract performance. When "b" is smaller than "a", then daily delay period activity is comparatively large and the Eichleay percentage is larger than the Fair Share Formula.

The Allegheny Formula will assign a smaller percentage of delay period fixed overhead to the Government than will the Fair Share Formula, unless there is no delay period activity. In the latter case, both methods will compute the same contract liability for delay period overhead. Otherwise, the Allegheny method will compute a smaller contract liability than the Fair Share Formula.

A final observation from this table. Edem had shown algebraically that the Eichleay Formula would always be greater than the government's share (6:119-120). This, however, does not seem to be the case. Previously it was shown that Edem's Formula was a special case of the Fair Share Formula. Edem's formula only considers the situation where contract activity is the only activity during the period of contract performance. Revising Edem's findings, the statement could be made that Eichleay will always exceed the government's share given the special circumstances of

Edem's example. The new formula has no such limitations. Now that the Fair Share Formula has been shown to be both accurate and predictable, a comprehensive test that emulates the task it would be faced with in the real world will be attempted.

DCAA Example

In the DCAA publication Audit Guidance Delay and Disruption Claims (5), an illustrative example is used to show the differences between the various methods of calculating the government's unabsorbed overhead liability. The intention here is to use the information presented there in the Fair Share Formula and compare these results with those computed by DCAA for the Allegheny and Eichleay Formulas. A complete copy of specifics of the example and the calculations accomplished for the two other formulas is contained in the Appendix. A brief summation of the situation follows:

> The ABC Company won a contract for construction at a Veterans Administration (VA) site that was to last for one year. Work proceeded according to plan for three months and then was stopped by an underground obstruction in the construction site (qualifying as a government caused delay). The work was stopped for six months. When the work recommenced, it was completed in the remaining nine months of the original contract period. (Excerpted from source 5:19-20)

In this example, the overhead allocation base is "direct costs" rather than "direct labor." This has no effect on the formula other than to change the term "direct labor" to "direct costs" in each formula equation.

In order to use the Fair Share Formula the following entering arguments are necessary.

Contract Percentage of Direct Costs
During Contract Performance Period

Non-Contract Percentage of Direct Costs
During Contract Performance Period

Non-Contract Percentage of Direct Costs
During the Delay Period

Another piece of information needed is the "normal" level of business in terms of the overhead allocation base. There are two methods that could be used in this situation. The contract bid overhead rate is given in this example. By dividing the fixed overhead by the overhead rate the original allocation base can be computed. Those figures look like this:

$$\frac{\text{Fixed Overhead}}{\text{Overhead Rate}} = \frac{\$140,000}{11.1\%} = \$1,262,261 \text{ annually}$$

$$\frac{\$1,262,261}{360} = \$3504 \text{ daily}$$

Another method would be to use the actual rate for the two years for which there is information in the example. Using the former method leaves the firm in, what would seem to be, an underabsorbing position and may increase the difficulty of this example. To fully test the Fair Share Formula, that will be the method used. The figures presented in the example were not developed with the Fair Share Formula in mind. Therefore, some assumptions as to the flow of non-contract

Table III

Direct Costs Breakdown
Contract vs. Non-Contract

	VA	Non-VA
July-Sep 1979	$405,000	$148,750
Sep-Dec 1979*	--	148,750
Jan-Mar 1980*	--	126,250
Mar-Dec 1980	495,000	378,750

* Indicates Delay Period

(Excerpted from source 5:20)

costs need to be made. On the second page of the example (See Appendix), the direct costs are broken down in six month periods, January - June and July - December for 1979 and 1980. These periods do not correspond to the delay period which is October 1979 - March 1980. It will be assumed that the costs flow evenly during these periods so that they can be divided into appropriate "Contract Performance Period" and "Delay Period" amounts. Table III contains the breakdown of contract and non-contract direct costs for the relevant periods.

The following data is necessary for computing the formula's entering arguments. It is excerpted from the example (See Appendix) and Table III. (All direct costs figures are daily.).

Total Delay Period Overhead $ 70,000
(Annual Overhead -:- 1/2 year delay =
$140,000 -:- 2)

Normal Business Level Direct Costs (See above)	$ 3,504
VA Contract Direct Costs (Contract Direct Costs -:- 360 days = $900,000 -:- 360)	$ 2,500
Average Non-VA Direct Costs (Contract Period) (Non-Contract Direct Costs -:- 360 days = [$148,750 + 378,750] -:- 360)	$ 1,465
Average Delay Period Direct Costs (Delay Period Direct Costs -:- 180 days = [$148,750 + 126,500] -:- 180)	$ 1,528
Delay Period	180 days

The following calculations are required to use the Fair Share Formula:

Contract Percentage of Direct Costs During Contract Performance Period ($2500/$3504)	= 71.34%
Non-Contract Percentage of Direct Costs During Contract Performance Period ($1465/$3504)	= 41.81%
Non-Contract Percentage of Direct Costs During the Delay Period ($1528/$3504)	= 43.61%

Substituting into the formula

Non-Contract Percentage of Direct Labor During the Delay Period	-	Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)
43.61%	-	41.81%	=	1.8%

Contract Percentage of Direct Labor During Contract Performance Period	-	Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead (lower limit = 0)
71.34%	-	1.8%	=	69.54%

Government's Percentage Share of Delay Period Overhead		Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead
69.54%	X	$70,000	=	$48,678

There are a number of interesting points that can be ferreted from the above calculations. First, this contract represents a large proportion of the contractor's business (71.34%) and, therefore, the government should expect to cover a large amount of the delay period overhead. Second, the "Factor" value of 1.8% indicates that, while the contractor did increase his non-contract work somewhat during the delay period, he was not able to replace the entirety of the contract. Third, while the contract overhead rate of 11.1%, when compared to the actual rate of 14%, would seem to leave the contractor in an underabsorbing position, this is not the case. If the contract had been completed without interruption, the contractor would have been in an overabsorbing position in 1979. He may have been in an underabsorbing position in 1980 if no other work was found after scheduled completion of the VA contract in June 1980. Further, the 14% does not take into account the reduced direct costs (allocation base) that was the direct result of the government caused delay. (This is where unabsorbed overhead comes from.) This example is similar to Example 4, Case 3. In both cases, the contractor is in somewhat of a business boom when the delay occurs. It is

the responsibility of the government to return the contractor to that position which he would have been were it not for the delay.

Comparison to the Allegheny and Eichleay Computations. DCAA has kindly calculated the Allegheny and Eichleay results in their example so those calculations will not be repeated here (see Appendix). The Allegheny Formula calculates a government liability of $5,828 (5:22) and the Eichleay Formula calculates $43,449 (5:20). Both results are lower than the Fair Share results. (Interestingly, the Eichleay Formula used here by the DCAA is a variation of the original formula (5:20) and computes a result significantly higher than the original Eichleay Formula would have.) Recalling Figure 3 (page 5-17) and Table II (page 5-16), it would seem that this example lies on the graph where the line is just beginning to go down. This is a "second region" example as previously discussed (page 5-11). In Table II, there is a range where the Fair Share Method exceeds the Eichleay. In this example, the gap between the Eichleay and the Fair Share Formula seems quite large. However, the results here are consistent with the principles that are the basis of the Fair Share Formula.

Summary

In this chapter, the Fair Share Formula has successfully solved the examples presented in Timothy Edem's 1985 research. It was discovered that Edem's final formula

is a subset of the Fair Share Formula and is only accurate in certain specific situations. The Fair Share Formula was compared to the Allegheny and Eichleay Formulas under conditions of changing delay period activity. It was found that the Allegheny Formula calculation, as Edem stated, remained well below the government's fair share except for two extreme instances (where they were equal), for the complete range of delay activity. The Eichleay was found to overstate the government's fair share in most instances, but contrary to Edem's findings, understates the government's fair share in situations where the contractor has other work continuing but is unable to replace a large portion of delayed contract work. This was the case in an example developed by DCAA in their Audit Guidance Delay and Disruption Claims (5) pamphlet. In this illustration, both the Allegheny and the Eichleay understated the government's fair share.

VI. Conclusions

Summary of Findings

In 1985 research, Timothy Edem studied the various formulas in existence for the determination of "quantum" in contractor's claims for unabsorbed overhead in delay cases. While his research proved that all existing formulas, including the two most popular, the Allegheny and the Eichleay, are inequitable in calculating the government's share of delay period overhead, he was unable to develop a comprehensive formula (6). The goal of this research has been to develop a new formula that would equitably calculate the government's fair share of this overhead in a variety of situations. The Fair Share Formula, developed here, is based on the contract law principle of "making the injured party whole." The development of this formula followed methods similar to those employed by Edem in 1985--that is, developing a relatively simple example from the computational point of view, but with a level of complexity in concept to allow for a generalization of the formula for use in the real world. The Fair Share Formula has accurately calculated the government's share in Edem's 1985 examples and two variations of the example used in formula development. It was further tested against an illustration in a DCAA audit guidance pamphlet (5). While there is no "right" answer associated with this illustration due to lack of complete information typical of examples, the vagaries

and impreciseness were in themselves a test of the practicality of the formula. It is usable and the results obtained by using the Fair Share Formula are understandable and logical. The results are consistent with the principles established at the beginning of this study.

Conclusions

The goal of this research has been attained. An equitable formula for use in unabsorbed overhead claims has been developed. The "Fair Share Formula" developed here is based on the legal concept of returning the injured party to a position similar to where he would have been had the contract been completed in full. The formula presented here accomplishes that goal. The formula appears below:

The Fair Share Formula

Non-Contract Percentage of Direct Labor During the Delay Period	-	Non-Contract Percentage of Direct Labor During Contract Performance Period	=	Non-Contract Absorbtion of Contract Overhead Factor (lower limit = 0)
Contract Percentage of Direct Labor During Contract Performance Period	-	Non-Contract Absorbtion of Contract Overhead Factor	=	Government's Percentage Share of Delay Period Overhead (lower limit = 0)
Government's Percentage Share of Delay Period Overhead	X	Overhead Incurred During the Delay Period	=	Government's Share of Delay Period Overhead

Entering Arguments

Contract Percentage of Direct Labor During Contract Performance Period	=	Daily Contract Direct Labor (During Contract) -:- "Normal" Daily Direct Labor
Non-Contract Percentage Of Direct Labor During Contract Performance Period	=	Daily Non-Contract Direct Labor (During Contract) -:- "Normal" Daily Direct Labor
Non-Contract Percentage of Direct Labor During Delay Period	=	Average Daily Delay Direct Labor -:- "Normal" Daily Direct Labor

What remains is for this formula to meet the final test--that of acceptance by the parties involved in unabsorbed overhead cases. A new tool has been provided; it is now up to the contracting officers, contractors, auditors, and boards and courts of appeal to use it as they see fit.

Appendix

Illustration - Unabsorbed Overhead - The ABC Co.

The following illustration show how different results can be obtained using the Eichleay, Allegheny, Simulation, and Burden Fluctuation methods of computing home office "unabsorbed overhead." In each case the same facts concerning ABC company are used.

The ABC Company

ABC Company was awarded a contract on 15 June 1979 to perform excavations for a V.A. hospital. Period of performance was to be one year commencing 1 July 1979 and the contract value was $1,100,000 composed of the following:

Direct Labor	$ 200,000
Field Overhead	50,000
Equipment	450,000
Other Direct Costs	200,000
Total Direct Costs	$ 900,000
Home Office Overhead @ 11.11%	100,000
Total Estimated Costs	$1,000,000
Profit	100,000
Contract Price	$1,100,000

The anticipated work schedule and billings were as follows:

	Direct Cost	Home Office Overhead	Profit	Billings
July 1979	$135,000	$ 15,000	$ 15,000	$ 165,000
August	135,000	15,000	15,000	165.000
September	135,000	15,000	15,000	165,000
October	90,000	10,000	10,000	110,000
November	90,000	10,000	10,000	110,000
December	54,000	6,000	6,000	66,000
January 1980	54,000	6,000	6,000	66,000
February	54,000	6,000	6,000	66,000
March	54,000	6,000	6,000	66,000
April	54,000	6,000	6,000	66,000
May	22,500	2,500	2,500	27,500
June	22,500	2,500	2,500	27,500
	$900,000	$100,000	$100,000	$1,100,000

The contract commenced on schedule and effort proceeded in accordance with the plan in July, August, and September. On 1 October 1979, work was halted due to an underground obstruction not considered in the specifications. This resulted in a six month total work stoppage for which the Government was responsible. The work resumed on 1 April 1980 and was completed on 31 December 1980.

ABC's actual home office overhead rate for calendar years 1979 and 1980 was 14% of direct costs (vs. 11.1% included in the initial bid) and was developed as follows:

	1979	1980
Direct Costs on Delayed VA Contract	$ 405,000	$ 495,000
Other Contracts Direct Costs	595,000	505,000
Total Direct Costs	$1,000,000	$1,000,000
Home Office Overhead (all Fixed)	140,000	140,000
Rate	14%	14%

The actual work schedule and billings for ABC Company's other contracts were as follows:

	Direct Costs	Home Office Overhead @11.11%	Profit @ 10%	Billings
Jan-June 1979	$ 297,500	$ 33,055	$ 33,055	$ 363,610
July-December 1979	297,500	33,055	33,055	363,610
Jan-June 1980	252,500	28,055	28,055	308,610
July-December 1980	252,500	$ 28,055	28,055	308,610
	$1,100,000	$122,220	$122,220	$1,344,440

Total days from start to finish for VA contracts (assume 30 day months):
18 months X 30 days = 540 days
Total VA contract delay period included in above:
6 months X 30 days = 180 days

1. Eichleay Type Method
This formula varies somewhat from the actual Eichleay decision.

a. Original Contract Price
Total billings for original contract period plus out-of-period costs on contract in question. X Fixed Overhead for Original Contract Period = Original Fixed Overhead Allocable To Contract

b. Original Fixed Allocable Overhead
Original Days of Performance = Daily Contract Fixed Overhead

c. Daily Contract Fixed Overhead X Days of Delay = Amount Recoverable

* * *

(1) $\frac{\$1,100,000}{\$1,772,220}$[1] X $140,000[2] = $86,898

(2) $\frac{\$86,898}{360}$ = $241.38

(3) $241.38 X 180 days = $43,449

1/ Consists of billings of $1,100,000 on delayed contract plus other contract billings for the period 1 July 1979 to 30 June 1980.

2/ Consists of one year home office overhead of $140,000.

The above formula, which was accepted by the Board in the Schindler Haughton Elevator Corporation decision, ASBCA N. 5390, 80-2 BCA 14671, varies somewhat from the formula used in the Eichleay decision in that the final contract price and actual period of contract performance were considered in the decision. Other Board cases where the formula used was consistent with the one used in the Eichleay decision are Robert McMullen & Son, Inc., ASBCA No., 19023, 76-1 BCA 11728 and Charles W. Schroyer, Inc., ASBCA No. 21859, 78-2 BCA 13513.

2. Allegheny Method

Plant Production and Delayed Contract Data

		1979	1980
a.	Total direct costs incurred	$1,000,000	$1,000,000
b.	Direct costs included in (a) incurred on subject delayed contract	405,000	495,000
c.	Total overhead incurred	140,000	140,000
d.	Overhead rate (c : a)	14%	14%

Determination of Unabsorbed Overhead

(1) Total actual overhead cost allocated to the contract

FY 1979 - $405,000 x 14% =	$ 56,700
FY 1980 - $495,000 x 14% =	69,300
e.	$126,000

(2) Total overhead cost which would have been incurred if no delay had taken place:

	FY 1979	FY 1980
(a) Total direct cost incurred	$1,000,000	$1,000,000
Delayed contract direct costs (Oct-Dec as anticipated)	234,000	(234,000)
Total adjusted direct costs	$1,234,000	$ 766,000
Total home office overhead costs	$ 140,000	$ 140,000
Adjusted overhead rate	11.34%	18.28%

(b) Adjusted contract overhead costs

FY 1979 - $639,000 x 11.34% =	$ 72,462
FY 1980 - 261,000 x 18.28% =	47,710
f. Total	$120,172

(3) Additional overhead costs due to contract delay (e - f) $ 5,828

3. Simulation Method

a. Contract Billings / Actual Days Worked = Average Contract Billings per day worked

b. Average Contract Billings Per Day Worked x Number of Days of Delay = Simulated Additional Work

c. Simulated Additional Work + Contract Billings = Simulated Contract Billings

Simulated Additional Work + Total Billings = Simulated Total Billings

d. Simulated Contract Billings / Simulated Total Billings x Total Home Office Overhead During Contract Period = Overhead Allocable to Contract

e. Overhead Allocable To Contract - Overhead Actually Allocated to Contract = Unabsorbed Overhead

* * *

a. $1,100,000 / 360 (12 months x 30 days) = $3,055.55 per day

b. $3,055.55 x 180 days delay (6 months x 30 days) = $ 550,000

c. $550,000 + $1,100,000 = $1,650,000

$550,000 + $2,080,830[1/] = $2,630,830

d. $1,650,000 / $2,630,830 = 62.7% x $210,000[2/] = $ 131,670

e. $131,670 - $126,000 (see computation under Allegheny method example) = $5,670 unabsorbed overhead

1/ Consists of contract billings of $1,100,000 plus other contract billings for the period 1 July 1979 to 31 December 1980.

2/ Consists of 1 1/2 years home office overhead of $140,000 = $210,000

4. Burden Fluctuation Method

a. Other Work Performed During Contract Period
1/2 1979 of $595,000 = $297,500
1980 of $505,000 = 505,000
$802,500(a)

b. Burden Fluctuation
Actual Rate of 14% - Bid Rate of 11.1% = 2.9%(b)

c. Unabsorbed Overhead (a) $802,500 x (b) 2.9% = $23,272

5. Impact of Unabsorbed Burden on Other Contracts

	Eichleay Method	Allegheny Method	Simulation Method	Burden Fluctuation Method
(a) Overhead Allocated to Delayed Contract at 14%	$126,000	$126,000	$126,000	$126,000
(b) Unabsorbed Overhead Attributed to Delayed Contract	43,449	5,828	5,670	23,272
(c) Total	$169,449	$131,828	$131,670	$149,272
(d) Actual Overhead During Contract Period	$210,000	$210,000	$210,000	$210,000
(e) Overhead Balance to be Allocated to Other Contracts (d-e)	40,551	78,172	78,330	60,728
(f) Other Contract Direct Costs	$802,500	$802,500	$802,500	$802,500
(g) Effective Rates (e:f) On Other Contracts (for period of contract performance)	5.1%	9.7%	9.8%	7.6%
(h) Effective Rates on Delayed Contract (c : $900,000)	18.8%	14.7%	14.6%	16.6%
(i) Bid Rate, all Contracts	11.1%	11.1%	11.1%	11.1%

(Source 5:19-23)

Bibliography

1. Allied Materials and Equipment Co., Inc., ASBCA No. 17,318, BCA, 75-1: 53,066-53,096 (February 1975).

2. Bedingfield, James P. and Howard W. Wright. Government Contract Accounting. Washington DC: Federal Publications, Inc. (1979).

3. Capital Electric Co., vs. The United States, No. 83-965, CAFC: 1-10 and 1-3 of Concurring opinion of Judge Friedman (7 February 1984).

4. Cost Accounting Standards Guide. Chicago: Commerce Clearing House, Inc. 1984.

5. Defense Contract Audit Agency. Audit Guidance Delay and Disruption Claims, DCAAP 7641.45 Washingtion DC: Government Printing Office, (January 1983).

6. Edem, First Lieutenant Timothy E. Claims for Unabsorbed Overhead on Defense Contracts. Technical Report AU-AFIT-GSM-LSQ-85S-10. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1985 (AD-A161 710).

7. Eichleay Corporation, ASBCA No. 5138, BCA, 60-2: 13,565-13,578 (July 1960).

8. The George Hyman Construction Company, ENG BCA No. 4541, BCA, 85-1: 89,334-89,362 (January 1985).

9. George E. Jensen Contractor, Inc., ASBCA No. 29,772, BCA, 85-1: 89,250-89,252 (November 1984).

10. Meigs, Walter B., Charles E. Johnson and Robert F. Meigs. Accounting: The Basis For Business Decisions (Fourth Edition). New York: McGraw Hill Book Company, (1977).

11. Nash, Ralph C., Jr. and John Cibinic, Jr. Federal Procurement Law, Volume II (Third Edition). Washington DC: The George Washington University, 1980.

12. R. W. Contracting, Inc., ASBCA No. 24627, BCA, 84-2: 86,205-86,227 (June 1984).

13. Trueger, Paul M. Accounting Guide for Government Contracts (Eighth Edition). Chicago: Commerce Clearing House, Inc. (1985).

VITA

Major Frank R. Groseth was born 9 August 1949 in Minneapolis, Minnesota. He graduated from high school in Richfield, Minnesota in 1967 and attended the University of Minnesota from which he received the degree of Bachelor of Science in Business (Accounting) in August 1971. In September 1971, he entered Officer Training School and received his commission in December. He completed navigator training and received his wings in September 1972. After completing advance bombing and navigation training, Major Groseth was assigned to the 2nd Bombardment Squadron and 22nd Bombardment Wing at March AFB, California where he served as navigator, radar navigator, flight insturctor, and flight evaluator in the B-52D. Major Groseth was reassigned in March 1980 to the 528th Bombardment Squadron and 380th Bombardement Wing at Plattsburgh AFB, New York where he served as navigator and instructor navigator in the FB-111A and as plans officer and Chief, Plans Branch, Operations Plans Division. In August 1983, while stationed at Plattsburgh, Major Groseth received the degree of Master of Business Administration from Rensselaer Polytechnic Institute, Troy, New York. He entered the School of Systems and Logistics, Air Force Institute of Technology, in May 1985.

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This research is a continuation of the research conducted by First Lieutenant Timothy Edem in 1985. While Edem's research studied the accuracy of a variety of formulas, this research concentrated on development of a new formula and its comparison to the two most popular formulas currently in use, the Allegheny and the Eichleay. The goal of this research was to develop a formula for use in unabsorbed overhead claims that would equitably determine the government's liability.

The formula development was based on the contract law principle of "making the injured person whole." It was using this principle that the government's share of delay period overhead was determined. The analysis and formula development were conducted in much the same manner as Edem's. Simple examples of possible real world situations were used to develop and evaluate the Fair Share Formula, as the new formula is called, and the results compared to solutions using the Allegheny and Eichleay Formulas. Edem's findings concerning the Allegheny Formula were validated here, however, his findings concerning the Eichleay Formula, while generally valid, were not completely valid. In some situations, the Eichleay Formula was found to understate the government's share of overhead. This occurred in a relatively small range of delay period activity and was offset by the large overstatement in a much larger range of activity. The Fair Share Formula accurately computed the government's share of delay period overhead through the full range of delay period activity. The results obtained here warrant the consideration of this formula for use in delay claims by contracting officers, contractors and Boards and Courts of Appeal.

END

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